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PRELIMINARY

MANUAL

TYPE 200 WAVEFORM SYNTHESIZER

AND

ASSOCIATED PLUG - IN GENERATORS

COMTRONICS SUITE 123-124 • NUMBER 2 HANFORD STREET
SEATTLE 4, WASH. • MAIN 4-5135

O P E R A T I N G P R O C E D U R E

I. FRONT PANEL FAMILIARITY

A. PRIMARY MATRIX (50 Black Knobs)

These potentiometers control the suppressor bias on the PRIMARY MATRIX readout tubes and provide 50 independantly variable (over a 50 volt range) increment levels to the plug-in. Order of continuous adjustment is front left to right in descending order.

B. SECONDARY MATRIX (50 Red Knobs)

These potentiometers control the suppressor bias on the SECONDARY MATRIX readout tubes and provide 50 independantly variable (over a 50 volt range) increment levels to the plug-in. Order of continuous adjustment is from left to right in descending order.

C. NEON INDICATORS

Neon bulbs located in the plate circuits of the Vertical and Horizontal counter switching tubes. The operating vertical row (5 neons) is indicated by the bulb which is ON. The operating vertical row (5 neons) is indicated by the bulb which is ON. The operating horizontal row (10 neons) is indicated by the bulb which is OFF. Intersection of the rows indicates the single increment in use.

D. B, C, D, E ON-OFF SWITCHES

DPDT slide switches are located in the plate circuits of four of the five Vertical Counter trigger tubes. The Vertical Counter skips whichever row or rows are turned to OFF. This provides a minimum of 10 increments (A cannot be turned off) and any combination of 10 up to 50.

II. TYPICAL OPERATION

Since the basic unit relies on the plug-in not only for trigger timing, but also for the forming of the output waveform, a more complete description of operating techniques will be found under OPERATING PROCEDURE in the PLUG-IN SECTION.

A. If less than 50 increments are desired, multiples of ten can be switched out by use of the A, B, C, or D ON-OFF SWITCHES.

B, C, D, E

Rows can be programmed and switched off to be used when desired with Row A.

II. TYPICAL OPERATION (continued)

CAUTION: Since these are ring counters, the unit may lock out on a single row if that switch is moved to OFF while that row is counting.

This will be more apt to happen at the faster speeds. If it does, either turn the switch ON and OFF again, or go to a slow speed where the neon indication can be observed and turn the switch to OFF while another row is energized.

B. The precise instantaneous output increment can be determined by the intersection of the neon indicators. For example: if the third neon from the left is OUT and the fourth neon from the top is ON, the output is from the 33rd increment.

C I R C U I T D E S C R I P T I O N

I. POWER SUPPLY

A. TRANSFORMER

Filament and all DC voltages are supplied by a single transformer T101 which operates between 105-125 volts (210-250 volts in export models). There are three hi-voltage secondaries and five 6.3 volt filament windings.

B. RECTIFIERS

Hi-voltage AC is rectified by silicon diode rectifiers connected in a full wave bridge.

C. -210V REGULATED SUPPLY

All DC voltages in the type 200 must have a stable reference voltage in order to properly regulate against load and input variations. V104, a gas diode, is this stabilized reference and sets the grid voltage on V103A. The -210V ADJ. is made to balance the supply for a -210 volt output. Any change in voltage appearing at the grid of V103B (including line voltage changes) will be compared to the reference voltage on the grid of V103A. Any difference will be great amplified by V102 causing V101 to be biased in the direction to correct for the change.

D. +100 VOLT SUPPLY

This supply operates in essentially the same manner as the -210 volt supply. The -210 volt supply becomes the reference and any variation of the grid of V106 is amplified and fed to V1076 for correction.

E. +250 VOLT SUPPLY

This supply operates in the same manner as the -210 volt and +100 volt supplies. The -210 volt supply is the reference and any variation at the grid of V108 is amplified and fed to V107a for correction.

F. -60 VOLT SUPPLY

This voltage is derived by dropping the -210 volt supply by 150 volts through the gas diode V313.

G. All power supply voltages are fed to the circuits of the SYNTHESIZER as well as to the interconnecting plug delivery volt power to the plug-in being used.

II. HORIZONTAL COUNTER

A. TRIGGER TUBES V205, V215, V220, V225, V230, V235, V240, V245 and V250

The trigger tubes are connected in a manner that allows the common trigger pulse on the cathodes (pins 7) to trigger the HORIZONTAL multivibrators (V204, etc.) in sequence only. (Only one HORIZONTAL multivibrator is in the "ON" position at any one time).

When V204, for example, is in the "ON" position, the grid (pin 2), being connected to the grid (pin 1) of V205, has a high enough potential to arm this trigger tube for the next stage.

When the next trigger pulse drives the common trigger cathodes (pins 7) negative, it will cause V205 to conduct and trigger V209, turning it "ON".

V250 furnishes trigger from screen to T201 which developes sharp spike to V317B. It is amplified and fed to VERTICAL COUNTER trigger tubes at the proper time.

B. SWITCHING TUBES V204, V209, V214, V219, V224, V229, V234, V239, V244 and V249

These are bi-stable multivibrator in a ring counter configuration. They are sequentially gated by the trigger tubes. Because of the common cathode connections, only one multivibrator can be "ON" at any one time. The stage is considered "ON" when the left tube is not conducting and the right tube is.

III. VERTICAL COUNTER

A. TRIGGER TUBES V303, V306, V309, V312 and V316

The trigger tubes are connected in a manner that allows the common trigger pulses on the cathodes (pins 7) to trigger the VERTICAL multivibrators (V302 etc.) in sequence only. (Only one VERTICAL multivibrator is in the "ON" position on any one time).

When V302, for example, is in the "ON" position, the grid (pin 2), being connected to the grid (pin 5) or V303, has a high neough potential to arm this trigger tube for the next stage.

When the next trigger pulse drives the common trigger cathodes (pins 7) negative, it will cause V303 to conduct and trigger V304, turning it "ON".

B. SWITCHING TUBES V302, V305, V308, V311, and V315

These are bi-stable multivibrator in a ring counter configuration. They are sequentially gated by the trigger tubes. Because of the common cathode connections, only one multivibrator can be "ON" at any one time. The stage is considered "ON" when the left tube is not conducting and the right tube is.

C. CATHODE FOLLOWERS V301, V304, V307, V310 and V314

These tubes are connected in parallel with their cathodes tied to a row of ten PRIMARY and ten SECONDARY MATRIX potentiometers. At any given time only one cathode follower is turned on by a switching tube. The other four are cut off thereby removing the remaining potentiometers out of operation. The one cathode follower conducting furnishes a current path for the corresponding row of PRIMARY and SECONDARY MATRIX controls.

IV. PRIMARY and SECONDARY MATRIX

These circuits, although separate in output, are identical in operation and circuit description. So only the PRIMARY MATRIX will be described. All features will apply identically to the SECONDARY MATRIX.

A. MATRIX CONTROLS

The 50 diodes and potentiometers in each matrix are identical in operation. The potentiometer, when a current path is furnished by a VERTICAL COUNTER cathode follower, adjusts the voltage to the suppressor grid of a readout tube through a matrix cathode follower. The diode properly isolates the voltage on each control from any of the other 4 on the common buss (Remember even though 5 vertical diodes are tied together, only one horizontal row is turned on at a time).

B. MATRIX CATHODE FOLLOWERS V201, V206, V211, V216, V221, V226, V231, V236, V241, V246

Provide isolation between readout tubes and matrix components.

C. MATRIX READOUT TUBES V202, V207, V212, V217, V222, V227, V232, V237, V242 and V247

Pentode amplifiers which provide selective amplification of matrix outputs (suppressor input). These tubes are switched on one at a time (control grid input), thus producing an output of only one increment at a time.

The suppressor grid voltages are determined by the individual settings of the matrix potentiometers in the "switched on" row.

Each control grid is connected to a corresponding HORIZONTAL COUNTER switching tube. Coincidence and corresponding readout of the suppressor voltage setting is obtained as each readout tube is sequentially "turned on".

V105 and associated circuitry provides the necessary total waveform compensation and low impedance output to the plug-in.

CALIBRATION PROCEDURE

he following is a factory calibration procedure and should rarely, if ever, eed to be completely duplicated once the instrument is in operation. It is rnished for your assistance in recalibrating certain sections after you ave made a major repair, or in checking operating during preventive main- enance.

I. POWER OFF (plug-in NOT installed)

A. VISIBLE WIRING CHECK

B. PRESET all trimmers and potentiometers to mid-position.

C. POWER SUPPLY RESISTANCES (20,000Ω/volt meter)

1. -210V reg. (3.5K)
2. +100V reg. (3.5K)
3. +250V reg. (20K)
4. +100V unreg. (5K)
5. +250V unreg. (15K)

II. POWER ON (install a plug-in generator)

A. TURN POWER ON

B. POWER SUPPLY VOLTAGES

1. Adjust -210V ADJ (on top left hand side of power supply chassis).

   Check potentiometer for sufficient range

2. Check +100V (±5%)

3. Check +250V (±5%)

C. CHECK COUNTERS FOR OPERATION

1. Switch TIME/INCREMENT switch in plug-in to slow range

2. Observe neon indicators for proper sequential counting (be sure all row switches are turned ON).

NOTE: IN ALL CHECKS REQUIRING AN OSCILLOSCOPE USE AN INSTRUMENT HAVING REGULATED POWER SUPPLIES AND DEPENDABLE ACCURACY

D. POWER SUPPLY RIPPLE (check with oscilloscope)

1. -210V (10-15 millivolts)
2. +100V (10-15 millivolts)
3. +250V (10-15 millivolts)

E. POWER SUPPLY REGULATION (using a Variac, vary the input voltage from 95 to 130 volts; the SYNTHESIZER should stay in regulation between 105-125 volts)

1. -210V
2. +100V
3. +250V

F. CHECK PEAK-CURRENT LIMITING RESISTANCE (10Ω resistors in power supply) VOLTAGE DROP

1. -210V (2 volts)
2. 100V (1.2 volts)
3. +250V (0.4 volts)

G. HORIZONTAL TRIGGER ADJ. (located in plug-in)

1. Run plug-in at 100μSEC. TIME INCREMENT

2. Monitor SCALE OF TEN out with oscilloscope and set oscilloscope gain high enough to see small spikes on base line along with large pulse.

3. Pull VERTICAL trigger tube V317 to eliminate any interaction from vertical trigger.

4. Turn HORIZ. TRIG. ADJ. through range and observe the change of time between large pulses.

5. By counting the spikes between pulses, set HORIZ. TRIG. ADJ. at optimum position on a count of 10.

H. VERTICAL TRIGGER ADJ. (Located below V249 on right hand underneath side of main chassis)

1. Replace VERTICAL trigger tube V317.

2. With oscilloscope monitoring the same as in Step "G" Adjust VERT. TRIG. ADJ. to point of oscillation and then back off several degrees.

3. Slightly readjust HORIZ. TRIG. ADJ. in plug-in for maximum stability.

4. Check VERTICAL trigger pulse at pin #3 V317. Should be approximately 3 volts with no negative going portion.

I. CHECK ALL COUNTING AND TIMING

1. Observe counters for operation throughout range of plug-in TIME/INCREMENT.

LIBRATION PROCEDURE (continued)

I. CHECK ALL COUNTING AND TIMING (continued)

2. Turn off row switches one by one and observe proper lockout. This should be done at slow TIME/INCREMENT speeds to avoid locking out on the row being turned OFF.

J. READOUT LEVEL - PRIMARY and SECONDARY

1. With an oscilloscope, monitor the junction of HORIZONTAL COUNTER plate dividers R2001 and R2021. The top of the pulse is at ground.

2. Adjust READOUT LEVEL ADJ., R2000 for approximately -20 volts

3. Check remaining plate divider junctions for -20 volts (±10%)

K. PRIMARY MATRIX COMPENSATION

1. Monitor pin #3 of V105 and observe the first 10 increments

2. Set each of the first 10 increments alternately positive and negative so that a square wave pattern is observed.

3. Adjust primary MATRIX COMP., C201 for squarest waveform.

L. SECONDARY MATRIX COMPENSATION

1. Monitor pin #8 of V105 and observe the first 10 increments

2. Set each of the first 10 increments alternately positive and negative so that a square wave pattern is observed.

3. Adjust secondary MATRIX COMP., C201S for squarest waveform.

M. PRIMARY READOUT COMPENSATION

1. Monitor pin #3 of V105 and observe first 10 increments.

2. Set first 10 increment levels to approximately mid-position.

3. Adjust primary READOUT COMP. trimmers C2001 thru C2010 (located in the plate circuits of the HORIZONTAL COUNTER switching tubes) for minimum spike. (330μsec/INC Pos.)

N. SECONDARY READOUT COMPENSATION

Monitor pin #8 of V105 and proceed as in Step M above adjusting secondary READOUT COMP trimmers C2011 - C2020.

ALIBRATION PROCEDURE (continued)

O. PRIMARY HIGH FREQUENCY ADJ.

1. Set plug-in TIME/INCREMENT to 10μsec.

2. Set all of first 10 increment levels to "0" except one, which is set to maximum positive amplitude.

3. Set test oscilloscope sweep speed to observe leading edge of pulse at pin #3 V105.

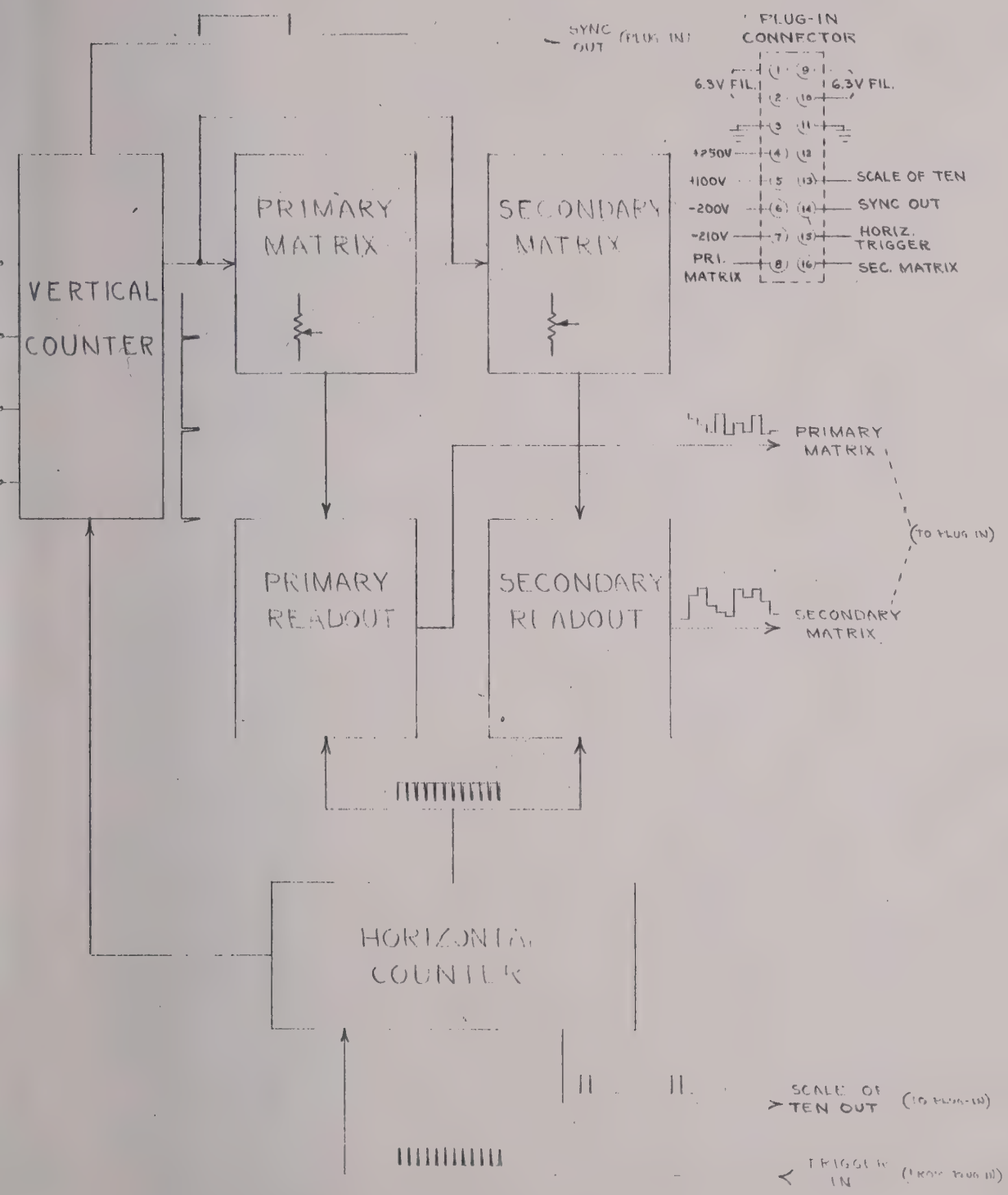
4. Adjust primary H.F. ADJ. L201 for sharpest wave front.

P. SECONDARY HIGH FREQUENCY ADJ.

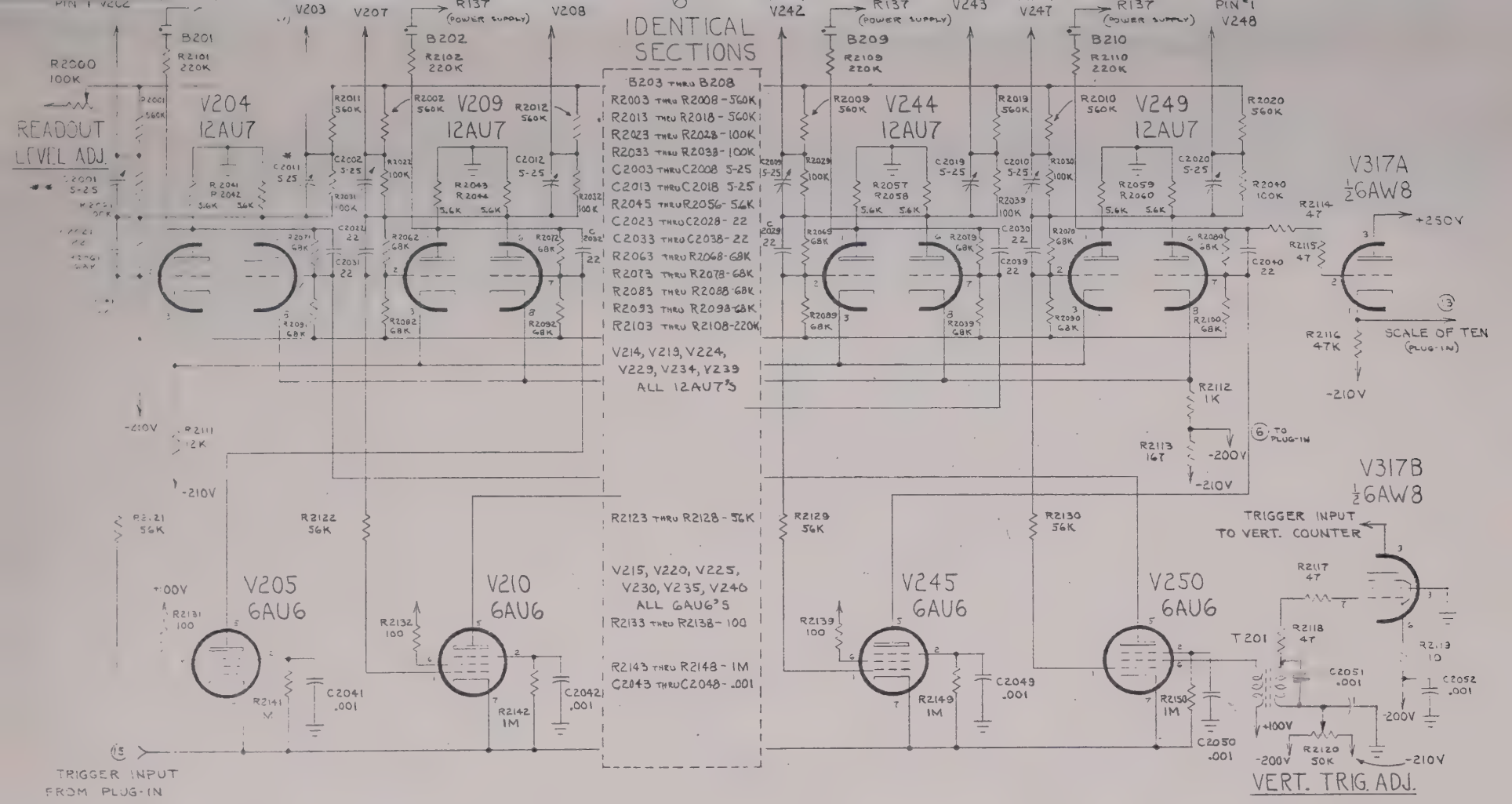
Monitor pin #8 V105 and proceed as in Step "O" above, adjusting secondary H.F. ADJ. L201s for sharpest wave front.

Q. Re-check all MATRIX controls for lack of interaction and full range.

BLOCK DIAGRAM



TYPE 200 WAVEFORM SYNTHESIZER

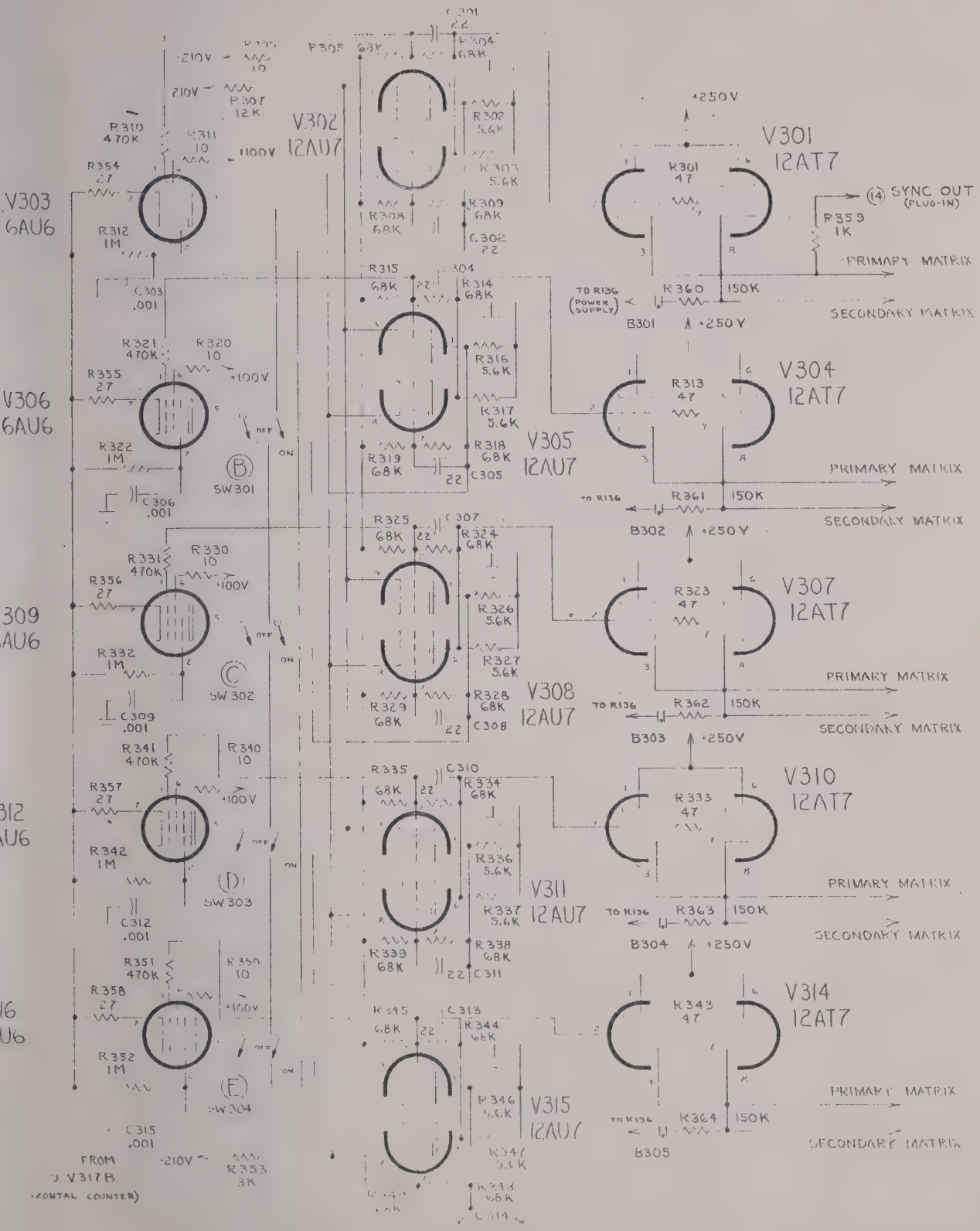


** C2001 THRU C2010 ARE PRIMARY. READOUT COMP.

* C2011 THRU C2020 ARE SECONDARY READOUT COMP.

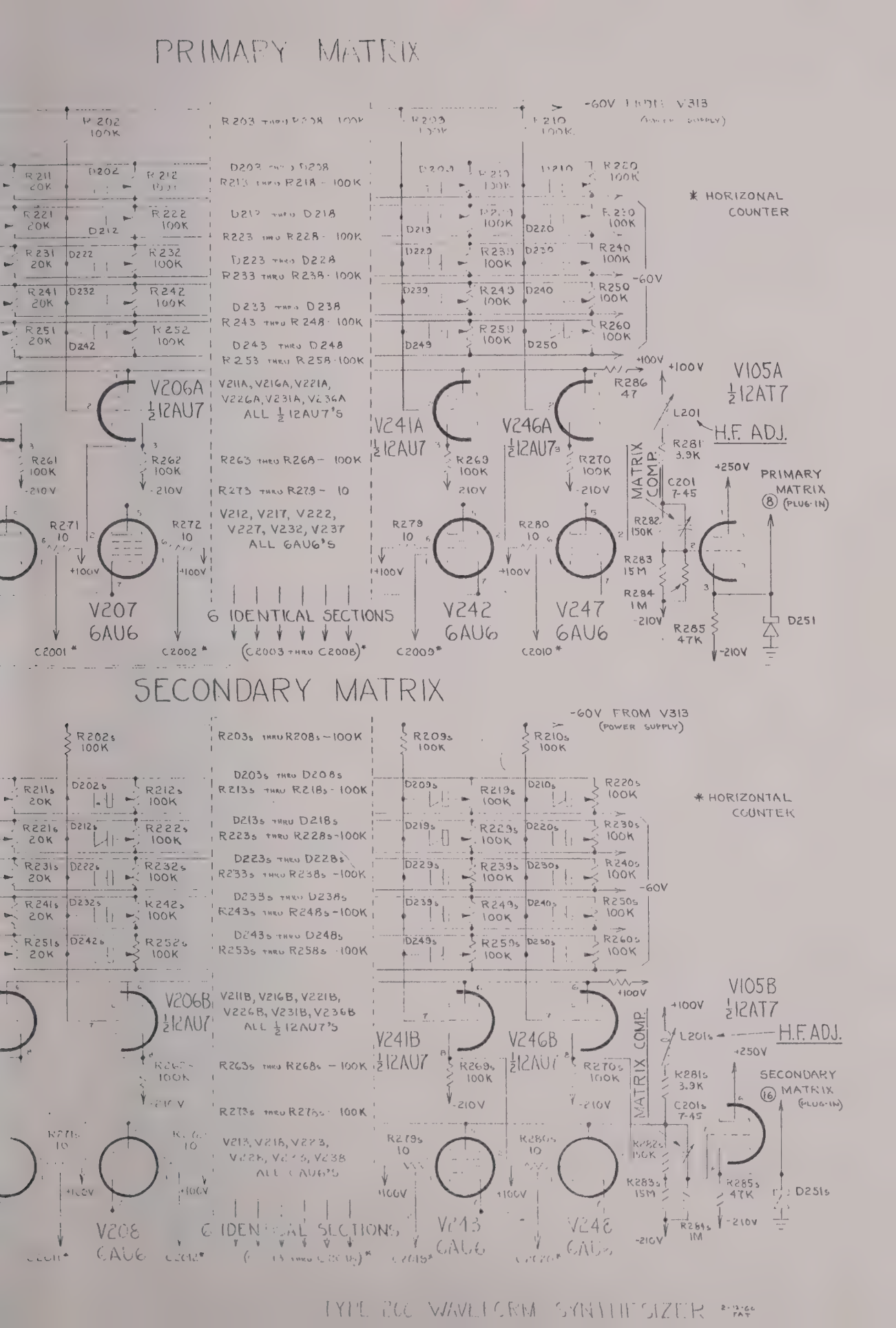
TYPE 200 WAVEFORM SYNTHESIZER 1-23-60 PMT

VERTICAL COUNTER

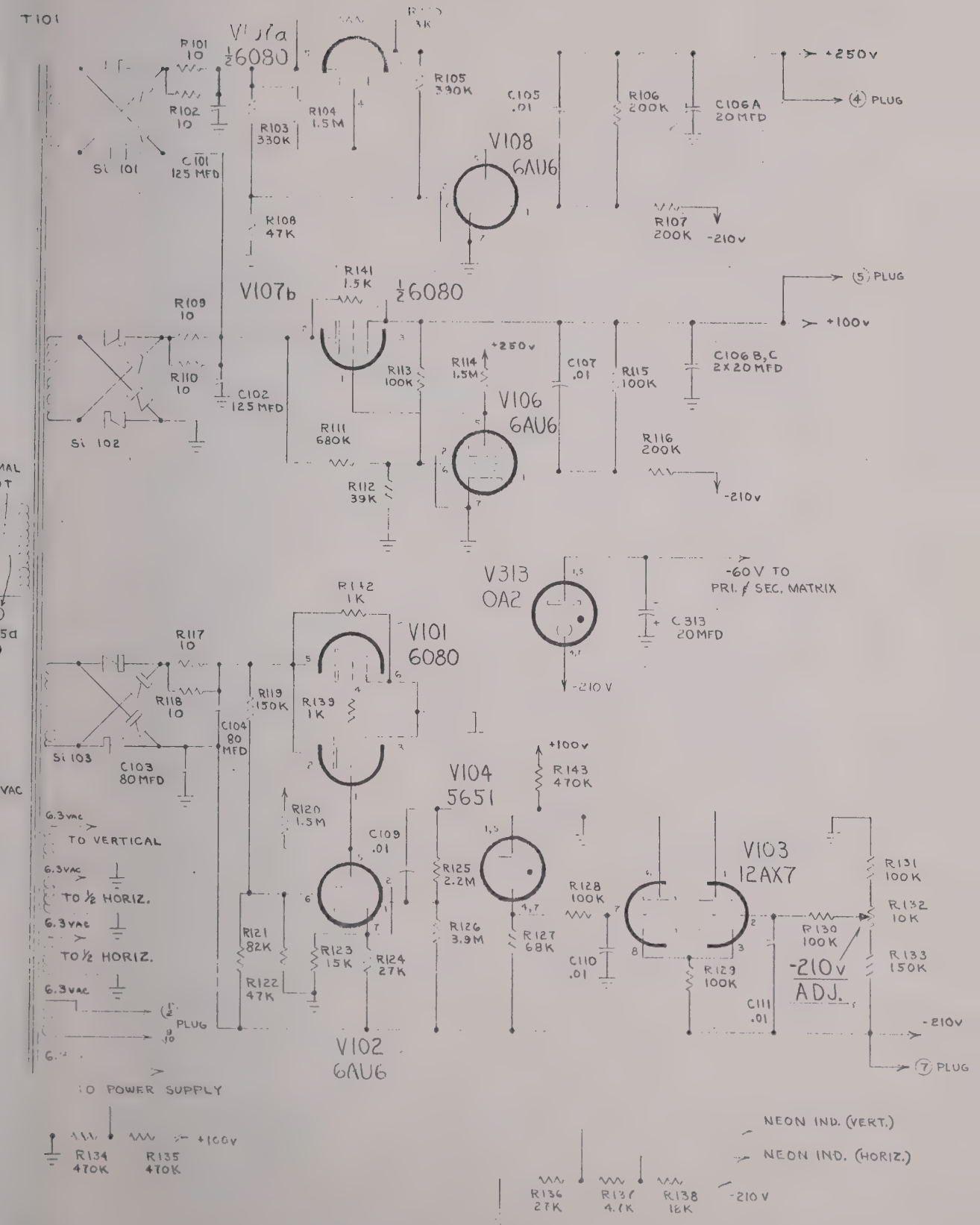


TYPE 606 WAVEFORM SYNTHESIZER

Note: All diodes on schematic on opposite page are connected with the anode to the center of the potentiometer. (D201 - D250 & $D201_S$ - $D250_S$)


PRIMARY MATRIX
R202 100K
R203 THRU R208 100K
D202
R211 20K
R212 100K
R221 20K
R222 100K
D212
R231 20K
D222
R232 100K
R241 20K
D232
R242 100K
R251 20K
D242
R252 100K
D203 THRU D238
R213 THRU R218 - 100K
D213 THRU D218
R223 THRU R228 - 100K
D223 THRU D228
R233 THRU R238 - 100K
D233 THRU D238
R243 THRU R248 - 100K
D243 THRU D248
R253 THRU R258 - 100K
V211A, V216A, V221A, V226A, V231A, V236A ALL ½12AU7'S
V206A ½12AU7
R261 100K
R262 100K
-210V
R263 THRU R268 - 100K
R273 THRU R278 - 10
V212, V217, V222, V227, V232, V237 ALL 6AU6'S
R271 10
R272 10
+100V
V207 6AU6
C2001*
C2002*
6 IDENTICAL SECTIONS
(C2003 THRU C2008)*
-60V FROM V313 (POWER SUPPLY)
R209 100K
R210 100K
D209
D210
R220 100K
D213
D220
R230 100K
D229
R239 100K
D239
R240 100K
D240
R250 100K
D249
R260 100K
D250
-60V
* HORIZONAL COUNTER
+100V
R286 47
V105A ½12AT7
L201
H.F. ADJ.
V241A ½12AU7
V246A ½12AU7
R269 100K
R270 100K
-210V
MATRIX COMP.
R281 3.9K
C201 7-45
+250V
PRIMARY MATRIX
(8) (PLUG-IN)
R279 10
R280 10
R282 150K
R283 15M
R284 1M
R285 47K
D251
V242 6AU6
V247 6AU6
C2009*
C2010*
SECONDARY MATRIX
R202s 100K
R203s THRU R208s - 100K
D202s
R211s 20K
R212s 100K
R221s 20K
R222s 100K
D212s
R231s 20K
D222s
R232s 100K
R241s 20K
D232s
R242s 100K
R251s 20K
D242s
R252s 100K
D203s THRU D208s
R213s THRU R218s - 100K
D213s THRU D218s
R223s THRU R228s - 100K
D223s THRU D228s
R233s THRU R238s - 100K
D233s THRU D238s
R243s THRU R248s - 100K
D243s THRU D248s
R253s THRU R258s - 100K
V211B, V216B, V221B, V226B, V231B, V236B ALL ½12AU7'S
V206B ½12AU7
R263s THRU R268s - 100K
R273s THRU R278s - 100K
V213, V218, V223, V228, V233, V238 ALL 6AU6'S
V208 6AU6
6 IDENTICAL SECTIONS
(C2009 THRU C2014)*
-60V FROM V313 (POWER SUPPLY)
R209s 100K
R210s 100K
D209s
D210s
R220s 100K
D219s
D220s
R230s 100K
D229s
R239s 100K
D239s
R240s 100K
D240s
R250s 100K
D249s
R260s 100K
D250s
-60V
* HORIZONTAL COUNTER
V241B ½12AU7
V246B ½12AU7
R269s 100K
R270s 100K
-210V
MATRIX COMP.
+100V
V105B ½12AT7
L201s
H.F. ADJ.
+250V
R281s 3.9K
C201s 7-45
SECONDARY MATRIX
(16) (PLUG-IN)
R279s 10
R280s 10
R282s 150K
R283s 15M
R284s 1M
R285s 47K
D251s
V243 6AU6
V248 6AU6
C2015*
C2016*
TYPE 200 WAVEFORM SYNTHESIZER

POWER SUPPLY



TYPE A
VARIABLE SLOPE GENERATOR

OPERATING INSTRUCTIONS

FRONT PANEL FAMILIARITY

A. OUTPUTS

1. The MAIN OUTPUT comes from cathode follower V18 and contains 10-20-30-40 or 50 increments each individually variable in amplitude and slope. Maximum available output power is 50V at 10 ma.

2. The MONITOR OUTPUT is identical to the MAIN OUTPUT and is isolated from it by a separate cathode follower.

3. The PRIMARY MATRIX OUTPUT comes from cathode follower V19 and contains the same number of increments with the same time base as the MAIN OUTPUT. Each increment is variable in amplitude only by the PRIMARY MATRIX knobs.

4. The SECONDARY MATRIX comes from cathode follower V3A. It is independent from the PRIMARY MATRIX, but also has the same number of increments with the same time base as the MAIN OUTPUT. Each increment is variable in amplitude only by the SECONDARY MATRIX knobs.

5. The SYNC OUT is derived from the cathode of V301 in the VERTICAL COUNTER. It is a 30V gate with a time duration equivalent to the time which row A is turned on (10 increments).

6. The SCALE OF TEN out is derived from cathode follower V317B in the HORIZONTAL COUNTER and is coincident with the tenth HORIZONTAL COUNTER pulse. It is a 40 volt gate acquiring every tenth increment and having a duration equal to one increment.

B. OUTPUT AMPLITUDE

This control, R1066, is located in the cathode circuit of V14 and V17A, and adjusts the gain of this stage over approximately a 3 to 1 range.

C. TIME/INCREMENT switch

Located in the grid circuit of V1, V2A, and V8A; this switch determines the time of the Miller trigger generator, trigger hold-off circuits and slope generator.

D. TIME/INCREMENT VARIABLE

This control, R44 is located in the grid circuit of V1 and permits a vernier adjustment to continuously cover all ranges set by the TIME/INCREMENT switch.

. FRONT PANEL FAMILIARITY (continued)

E. TRIGGER GENERATOR

This two position rotary switch is located in the grid circuit of V6 and determines whether the trigger generator will be free-running at the desired rate or completely inoperative.

V. WAVEFORM CONTINUITY

The control, R1045 is located in the CATHODE CIRCUITS of V12 and V13. It provides adjustment to compensate for slight over-all waveform discontinuities when switching varies. Normal setting is at zero (midrange).

I. TYPICAL OPERATION

Connect the SYNC OUT from the TYPE "A" to the oscilloscope trigger input or to the system input to be triggered. Connect the MAIN OUTPUT to the circuit, system or instrument under test and the MONITOR output to the oscilloscope input.

Turn the TRIGGER GENERATOR to ON and set the TIME/INCREMENT switch to the desired increment duration desired.

Check the row switches on the Type 200 for the number of increments you want the total waveform to contain.

Adjust each PRIMARY MATRIX knob (black) for the increment amplitude desired, then adjust the concentric SECONDARY MATRIX knob (red) for the needed amount of slope. Each pair of PRIMARY and SECONDARY adjustment should be made until the total required output waveform is achieved. The TIME/INCREMENT range or OUTPUT AMPLITUDE may now be varied without any loss in relative shape of the output.

If the increments appear to have drifted slightly apart when you have changed ranges, adjustment of WAVEFORM CONTINUITY should return them to the original setting.

II. SLOPE GENERATOR

A. SQUARE WAVE GENERATOR (V7, V9 and V10)

The slope trigger pulse is amplified by V7. Since the plates (pins 6 and 1) are tied to the plates of the bi-stable multivibrator V10, each pulse reverses the condition of V10, producing a symmetrical square wave on pin 6.

The square wave is shaped and amplified by V9.

B. TRIANGLE GENERATOR (V8)

The symmetrical square wave is integrated by R1077 and C1021 in the cathode circuit of V8A (pin 3).

A cathode follower (V8B) is used for the output of the triangle waveform.

C. TRIANGLE AMPLIFIER AND INVERTER (V12 and V13)

A paraphase amplifier (V12 and V13) produces two amplified triangle waveforms that are 180° out of phase with each other.

The degeneration control R1045 controls the relation amplification of each tube for CONTINUITY ADJUST. CONTINUITY BAL ADJ, R1042 adjusts the DC level of V13 cathode (pin 7) equal to that of V12 cathode (pin 7).

This prevents a DC shift when the CONTINUITY ADJ is varied.

R1038 in the plate circuit is gauged with the VARIABLE TIME/INC CONTROL to maintain proper slope amplitude when time is changed.

TRIANGLE AMP BAL, R1036, is adjusted for equal DC levels on plates of V12 and V13.

D. SLOPE MIXER (V15 and V16)

The two out-of-phase triangle waveforms are fed to the suppressors (pins 2) of the mixer circuit (V15 and V16).

Since the SECONDARY MATRIX waveform is connected to the grid (pin 1) of V16, variations in increment level will determine the relative amplification of each of the out-of-phase triangle waveforms. (SLOPE MIX BAL control sets the DC level of the grid of V15 equal to that of V16).

The common output of V15 and V16 consists of slopes that vary in degree according to the levels of the SECONDARY MATRIX waveform.

E. OUTPUT (V17B, V14, V17A, V18)

Mixing of the PRIMARY MATRIX increment levels with the slopes is accomplished by the network in the grid circuit of V14 (pin 2). OUTPUT DC LEVEL, R1078, sets the DC level of the composite waveform.

The OUTPUT ATTENUATOR, R1065, varies the gain of V14 and consequently the amplitude of the output waveform.

Cathode of V17A (pin 3) is adjusted to the same DC level as the cathode of V14 (pin 1) by the OUTPUT DC BAL, R1071. This prevents any DC shift during operation of the OUTPUT ATT.

Cathode followers V18A and V18B provide isolated outputs for the MONITOR and MAIN OUTPUT.

F. SLOPE PHASE LOCK (V11A)

This circuit prevents the slopes from reversing by insuring that the bi-stable multivibrator, V10, does not operate 180^{o} out of phase. (The multi can start in either mode when the instrument is turned on).

The scale-of-ten pulse is differentiated and the negative portion clipped in the cathode circuit of V11A. This pulse is coupled through variable capacitor C1002 to the input of the trigger tube V7. The pulse is of sufficient amplitude to force V10 to lock in phase, regardless of how it starts.

CALIBRATION PROCEDURE FOR EXACT

TYPE A VARIABLE SLOPE PLUG - IN

TEST EQUIPMENT REQUIRED

1. An oscilloscope with a response of DC to 5 MCS or better; sensitivity of 1 volt/cm.
2. Volt/Ohm Meter of 20,000 ohms/volt
3. Screwdriver with insulated shaft

POWER OFF (plug-in out of instrument)

1. VISUAL INSPECTION
2. POWER LOAD RESISTANCES
   - A. Using ohmmeter, measure resistance from voltage lead to ground:
     1. -210 Volt (approximately 7KΩ)
     2. -200 Volt (approximately 200K)
     3. +100 Volt (approximately 70K)
     4. +250 Volt (approximately 90K)

POWER ON (plug-in placed in instrument. Power turned on)

TIME GENERATOR

1. RATE GENERATOR STABILITY
   - A. Monitor pin 5 of V4 with test oscilloscope (if no signal is observed, check to see that front panel TIME GEN switch is on).
   - B. Adjust RATE GEN. STABILITY for stable sawtooth pattern which disappears when front panel TIME GEN switch is turned off.
2. TIMING ADJUST
   - A. While still observing sawtooth pattern on pin 5 of V4, turn front panel TIME/INC switch to 1 millisec/INC position. (VARIABLE control fully clockwise)
   - B. Check for 1 sawtooth/millisec. If required, adjust RATE TIMING (R41).
   - C. Check time in all ranges of TIME/INC switch except 3 fastest positions.

3. H.F. TIMING

A. With TIME/INC switch in 10μsec/INC position, adjust C7E (mounted on switch) for correct time.

B. Check timing in 33μsec/INC position (C7E adjusts for this position also).

C. With TIME/INC switch in 3μsec/INC position, adjust C7G for correct time.

4. VARIABLE TIME CONTROL

A. Check the front panel VARIABLE TIME CONTROL for 3 to 1 range.

TRIGGER OUTPUTS

1. HORIZONTAL TRIGGER OUTPUT

A. With test oscilloscope monitoring pin 7 of V11B, observe positive trigger pulse of approximately 8 volts amplitude.

NOTE: PULSE IS NARROW AND FAST. TURN UP INTENSITY ON TEST OSCILLOSCOPE

2. SLOPE TRIGGER OUTPUT

A. Observe pin 7 of V7 with test oscilloscope for presence of positive slope trigger pulse of approximately 5 volts amplitude.

3. HORIZONTAL TRIGGER ADJUST

A. With test oscilloscope monitoring PRIMARY MATRIX (front panel output jack), adjust HOR TRIG control for correct output.

Best procedure is to switch off all but top row of knobs on instrument. Adjust for stable pattern of 10 increments. Turn all rows back on, check for 50 increments.

SLOPE GENERATOR

1. SQUARE WAVE GEN OUTPUT

A. Observe pin 3 of V8 with test oscilloscope. A symmetrical square wave should be seen. Center of waveform should be at approximately ground level.

B. If required, adjust C1006 and C1008 for minimum spike and flattest top. These adjustments are best made with TIME/INC switch in the 330μsec/INC position.

2. TRIANGLE GENERATOR

A. A triangle waveform should be observed at pin 8 of V8.

3. TRIANGLE AMP BALANCE

A. Using test oscilloscope, observe plates of V12 and V13 (pins 5). (Front panel VARIABLE time control should be clockwise; CONTINUITY ADJ at zero).

D.C. levels of waveforms should be the same.

B. If D.C. levels are different, try interchanging V12 and V13 to see if tubes are not balanced.

C. If necessary, adjust TRIANGLE AMP BAL so both waveforms have same D.C. level

NOTE: If dual channel oscilloscope is available, it is easier to make adjustment by monitoring both waveforms simultaneously and superimposed on each other.

4. SLOPE MIXER

A. Observe waveform on pin 5 of V16. Turn slopes so they are all slanting in the same direction by manipulating knobs on front of instrument.

B. Although slight difference in amplitude of slopes may be present, they should be in alignment with each other. (adjust C1013 for best linearity or minimum spike if required).

C. If slopes are not in alignment, adjust SLOPE MIXER BAL for best alignment without distortion (interchange V15 and V16 first to see if tubes are out of balance).

OUTPUT

1. OUTPUT LEVEL AND ATTENUATOR BAL

A. Monitor front panel OUTPUT with test oscilloscope. Adjust several rows of front panel black knobs to alternately maximum and minimum settings.

B. Adjust OUTPUT LEVEL for D.C. level of "ground potential" at center of waveform.

C. While rotating front panel OUTPUT ATTENUATOR control back and forth, adjust OUTPUT DC BAL for minimum D.C. shift.

NOTE: OUTPUT D.C. BAL and OUTPUT LEVEL controls have interaction. Readjustment of both several times may be required for optimum settings.

Adjustment should be made without causing distortion of waveform.

2. MATRIX MIXING COMPENSATING CAPACITORS

A. Monitor front panel OUTPUT with instrument in 330μsec/INC position. Adjust several increments to mid-range with flat tops.

B. If necessary, adjust C1016 and C1017 for minimum spike and flattest tops.

SLOPE PHASE LOCK ADJ (V11A, C1002)

1. If all slopes should reverse direction 180° at any time during use of instrument, adjustment of C1002 is indicated.

A. Monitor OUTPUT with test oscilloscope. Time/INC or 330μsec/INC. Turn a number of slopes all one direction.

B. Turn C1002 to minimum setting. Using tip of screwdriver, quickly tap plate circuit of V10 (pin 1 or 5) several times until you observe slopes reverse 180°.

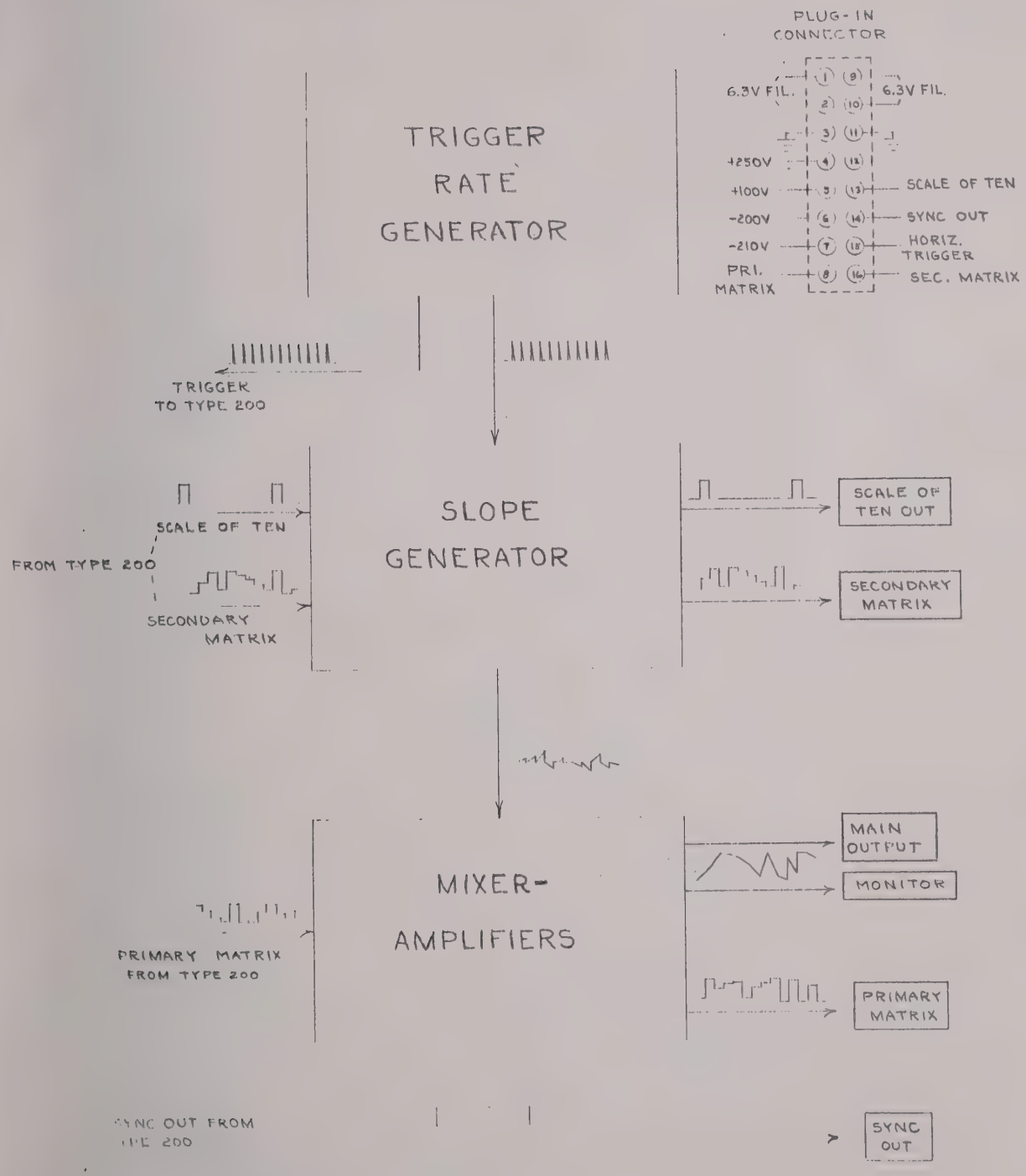
C. Turn C1002 until slopes flip back to normal. Increase capacitor setting a very small amount more.

NOTE: If slopes do not flip, repeat Step B.

D. Check OUTPUT waveform at fast speeds.

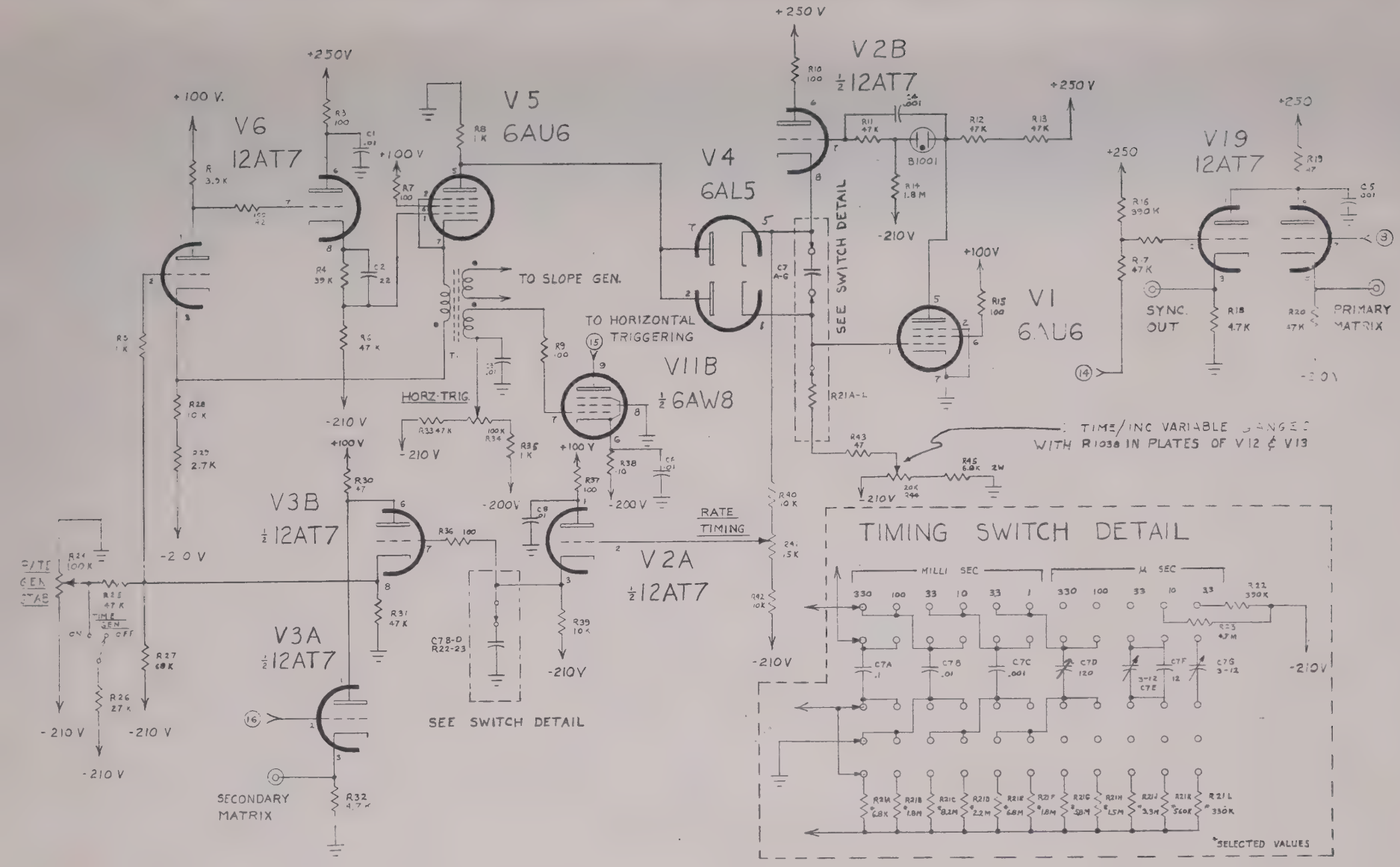
If C1002 is set too high, distortion or time irregularities will occur at faster rates.

BLOCK DIAGRAM

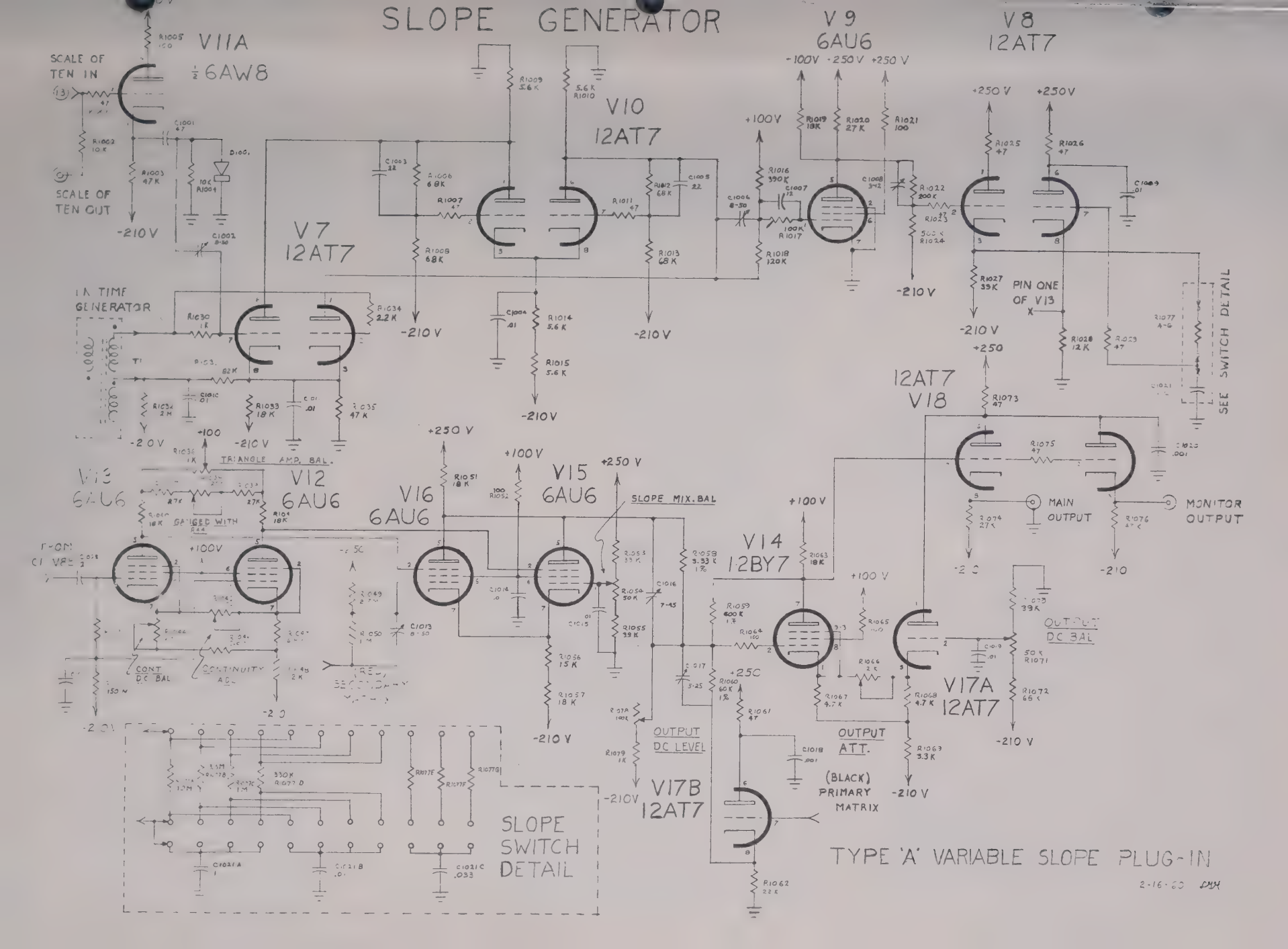


TYPE A SLOPE GENERATOR PLUG-IN

TIME GENERATOR

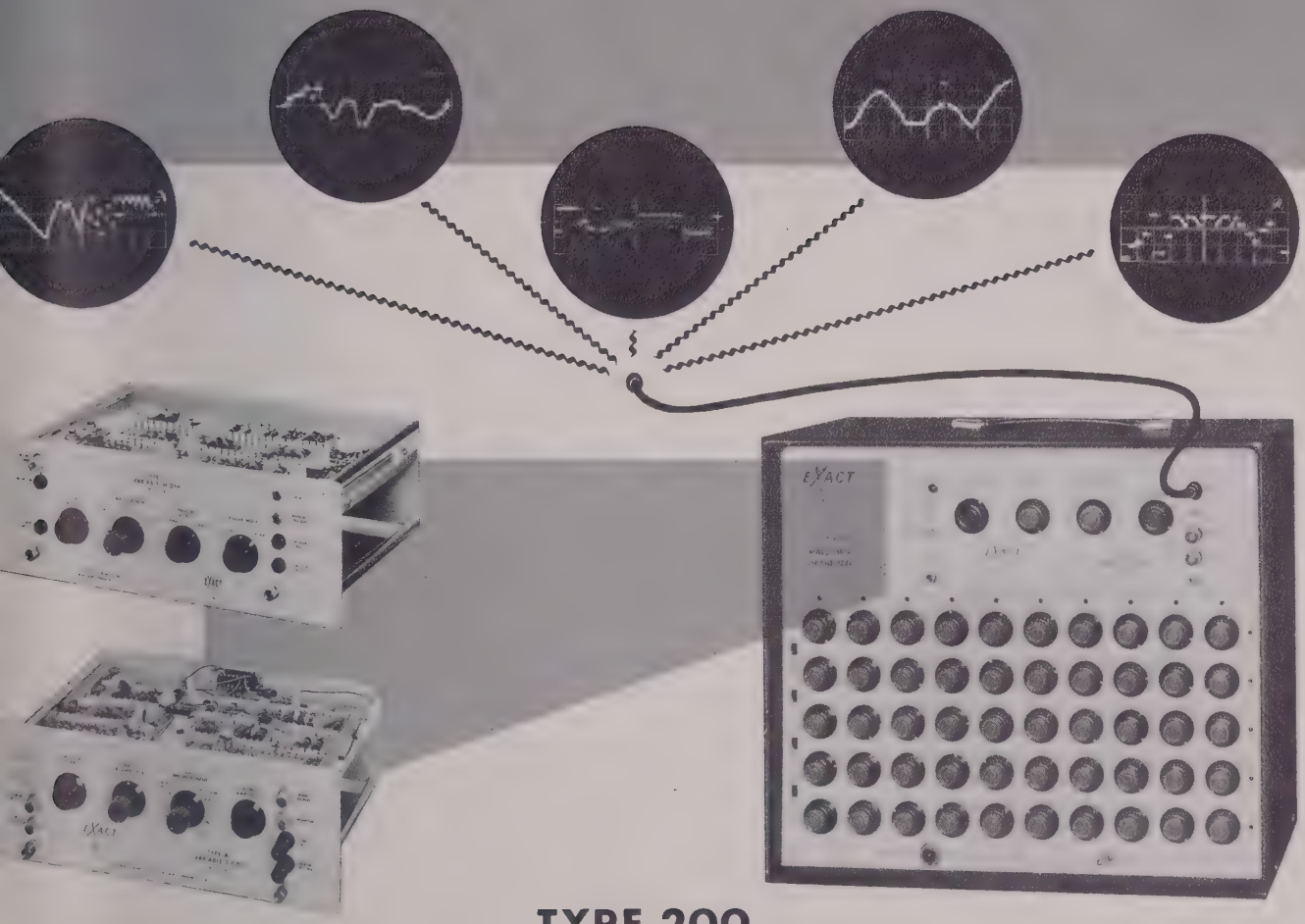


TYPE 'A' VARIABLE SLOPE PLUG-IN 1-23-60 PAT


SLOPE GENERATOR
V11A
½ 6AW8
SCALE OF TEN IN
SCALE OF TEN OUT
-210V
V7
12AT7
1A TIME GENERATOR
-20V
TRIANGLE AMP. BAL.
V13
6AU6
V12
6AU6
V10
12AT7
V16
6AU6
V15
6AU6
SLOPE MIX. BAL
V9
6AU6
-100V -250V +250V
V8
12AT7
+250V
V14
12BY7
V18
12AT7
MAIN OUTPUT
MONITOR OUTPUT
PIN ONE OF V13
SEE SWITCH DETAIL
V17A
12AT7
OUTPUT DC BAL
OUTPUT DC LEVEL
OUTPUT ATT.
V17B
12AT7
(BLACK) PRIMARY MATRIX
SLOPE SWITCH DETAIL
TYPE 'A' VARIABLE SLOPE PLUG-IN
2-16-60

WAVEFORMS UNLIMITED

AT YOUR FINGERTIPS



TYPE 200

WAVEFORM SYNTHESIZER

AND

PLUG-IN GENERATORS

EXACT

EXACT ELECTRONICS, INC. P. O. BOX 552 PORTLAND 7, OREGON

TYPE 200 WAVEF

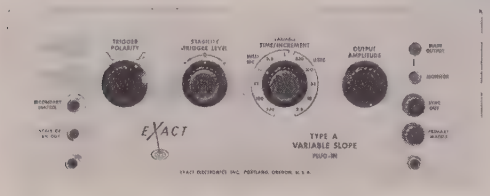
Each of the two groups of 50 knobs on the front panel of the **Synthesizer** adjusts a characteristic of a small segment of the total output waveform. Which characteristic—amplitude, slope, width, etc.—is determined by the plug-in generator being used with the **Type 200.**

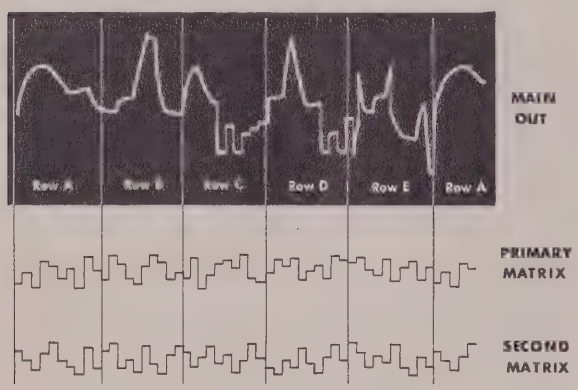
The plug-in generators furnish the versatility of triggering and lockout features as well as a wide range internal timing source necessary for the basic **Type 200.** The desired complex main output from the plug-in is then a result of combining the two independent **Type 200** increment outputs (primary matrix secondary matrix).

The ease and speed in producing nearly any waveshape n gives this instrument application in every scientific field. A are listed below:

COMPUTER PROGRAMMING — PCM-PTM SYSTEM
BASIC RESEARCH — SPECTRUM SIMULATIO
SERVO DESIGN & TEST — RADAR PULSE CODIN
SPEECH AND SOUND SYNTHESIS
TELEMETERING CHANNEL SYNTHESIS

TYPE A — VARIABLE SLOPE GENERATOR





MAIN OUTPUT

No. of increments ..... 10, 20, 30, 40, or 50
Time/increment ..... 1 sec. to 3.3 μsec.
Increment Amplitude ..... 0-50 v variable
Increment Risetime ..... 0.4 μsec
Time Jitter ..... 1 part in 10,000/incr.
Amplitude Stability ..... .5% of max. ampl.
Slope limits (each incr.) .... 20% or ±10 v, whichever greater
Waveform continuity ..... within 3%
Waveform power ..... 50 v @ 10 ma
Overall waveform ampl. ..... var. over 3 to 1 range
Waveform ref. level ..... factory adj. 0

PL

The **Type "A"** plug-in produces a main output waveform havi 10, 20, 30, 40 or 50 increments (segments) with independently va able amplitude and slope. Continuously variable timing over wide range permits creation of sine waves, irregular waveforn sawtooths and triangular functions, discontinuous waveforms, e Auxiliary outputs provide variable amplitude increments with t same time base as the main output.

TRIGGERING

Internal ..... free running generator

MATRIX OUTPUTS

Increment Amplitude ..... 0-10 v variable
Increment Risetime ..... 0.2 μs
All other specifications same as MAIN output

GENERAL

Scale of ten out ..... 40 v gate every 10th increment
Sync out ..... 30 v amplitude
Monitor ..... Isolated output parallel to main output
Accessories included ..... Sync out cable Main output coax

Price **$325**
f.o.b. factory

TENTATI

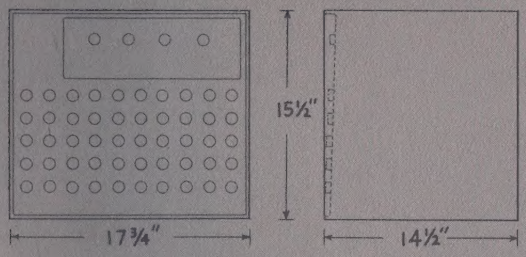
TYPE D CONTINUOUS WAVEFORM GENERATOR

The ouptut from this plug-in combines the features of slope and width. An output is produced which is an uninterrupted waveform composed of increments having independently variable width and slope. This unit will provide a trigger lockout feature and wide range continuous timing.

Tentative production ..... **August 1960**
Tentative price **$300**

EXACT ELEC

RM SYNTHESIZER

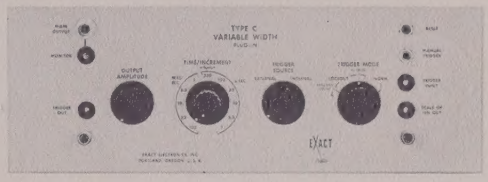


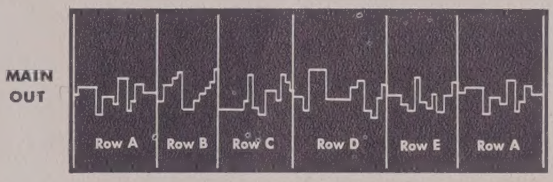
GENERAL SPECIFICATIONS

No. of increments ..... 10, 20, 30, 40 or 50
Increment position ..... indicated by neon bulbs
Power req. ..... 105-125 v 50-60 cps. 425 watts
Weight ..... 58 lbs

TYPE 200 **$1575**
TYPE 200 RM **$1600**
f.o.b. factory

VARIABLE WIDTH GENERATOR TYPE C





ıe Type "C" plug-in produces an output waveform made up of ements having independently adjustable width as well as ampli-. The number of increments in the total waveform can be con-ed through a lockout-reset feature which permits internal or rnal sequence gating. Incremental pulse widths from 1 μsec to :. are available. A monitor jack is provided for parallel ocsil-ope observation.

TRIGGERING

In the LOCKOUT MODE the generator can be armed and, depending on the TRIGGER SOURCE, will either nternally generate a pre-set number of increments or wait for additional external or manual triggering

Lockout by 10 count ..... re-arm for each row of ten incr.
Lockout by program count ..... re-arm for each total no. of rows (10, 20, 30, 40, or 50 incr.)
Normal Mode ..... No lockout feature
INT source .....Free Running Generator at Time/Increment Rate
EXT. source ..... 5 v at 1 μsec. RT
Manual (EXT.) ..... single shot

MAIN OUTPUT

No. of increments ..... 10, 20, 30, 40, or 50
Time/increment ..... 1 sec to 1 μsec.
Increment amplitude ..... 0-50 variable
Time Jitter ..... 1part in 10,000/incr.
Amplitude stability ..... 0.2% of max. ampl.
Variable width ratio ..... 1:10 per incr.
Waveform power ..... 50 v @ 10 ma
Overall waveform amplitude .... Var 3 to 1 range
Waveform ref. level ..... Factory Adj. to 0

GENERAL

Scale of ten out ..... 40 v gate every 10th incr.
Sync out ..... +30 Volts
Monitor ..... isolated output
Accessories included: Sync out cable
Main output coax

Price **$300**
f.o.b. factory

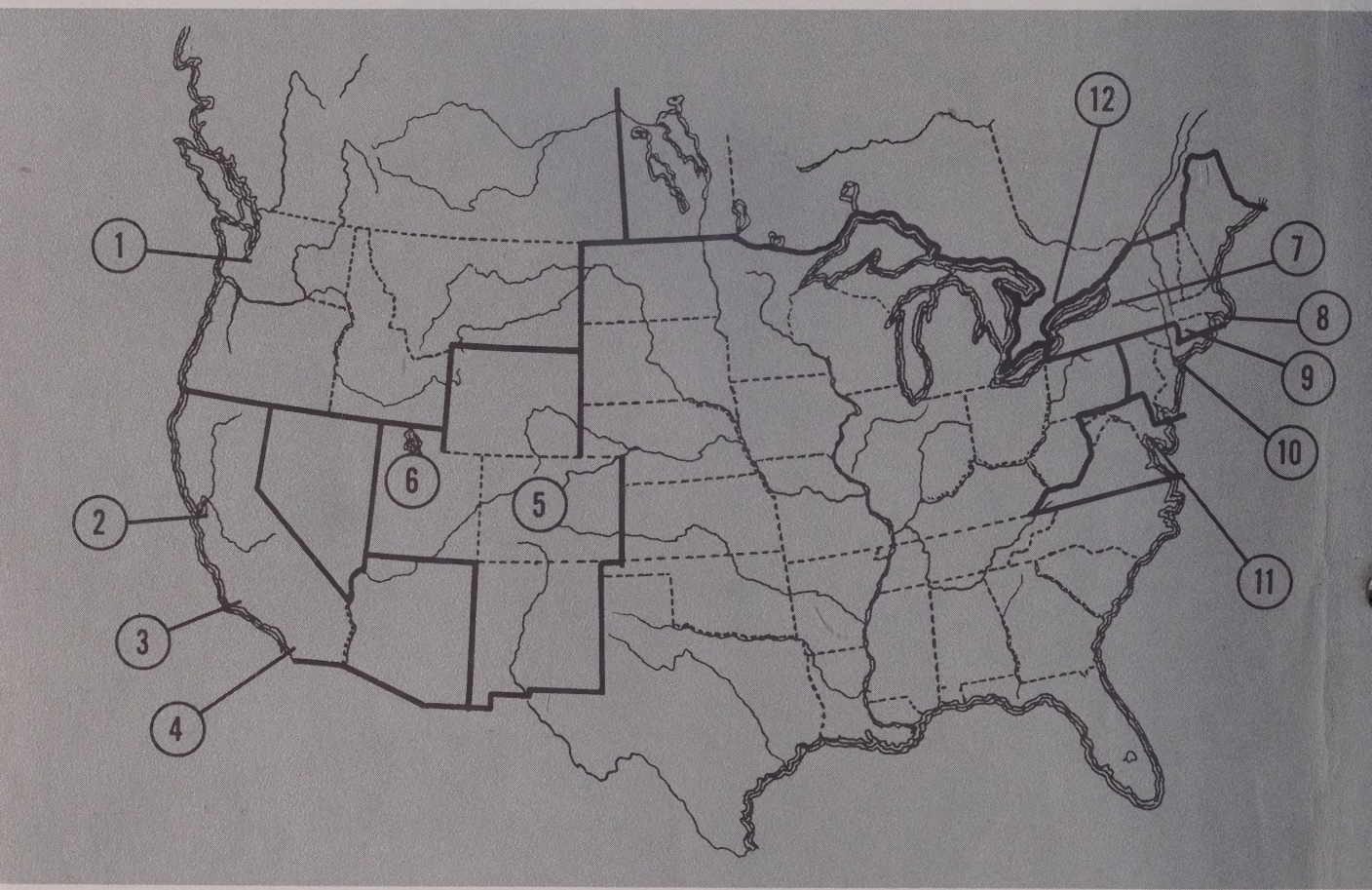
LUG-INS

TYPE E PULSE TRAIN GENERATOR

This plug-in takes the two independent matrix outputs from the basic Type 200 and arranges them to run concurrently for a main output of 100 increments variable in amplitude and timing. This unit will be very useful in stairstep and pulse train applications.

Tentative production ..... **August 1960**
Tentative price **$200**

RONICS INC.



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